

Occupational Safety Competency 1.12

Competency 1.12 Occupational safety personnel shall demonstrate a working level knowledge of safety considerations associated with industrial operations.

1. Supporting Knowledge and Skills

- a. Discuss common industrial and maintenance operations (i.e., welding, material handling, machining, cleaning, coating, etc.) and the safety interfaces necessary to protect workers.
- b. Describe the safety considerations associated with the placement of operations and equipment (i.e., location of personnel in the proximity of moving equipment or parts, traffic patterns, structural support for equipment, etc.).
- c. Discuss point of operation hazards associated with workplace equipment and describe principles of appropriate machine guarding.
- d. Discuss common concerns and associated control measures which must be addressed in the workplace environment (e.g., noise, thermal burn hazards, heat stress, vibration, eye hazards, workplace illumination, etc.).
- e. Discuss the hazards associated with non-ionizing radiation and describe the appropriate control measures.

2. Self-Study Activities (corresponding to the intent of the above competency)

Below are two web sites containing many of the references you may need.

Web Sites		
Organization	Site Location	Notes
Department of Energy	http://wastenot.inel.gov/cted/stdguido.html	DOE Standards, Guides, and Orders
OSHA	http://www.osha-slc.gov/	OSHA documents and search engine
U.S. House of Representatives	http://law.house.gov/cfr.htm	Searchable Code of Federal Regulations

Read the Summary section below.

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Review 29 CFR 1910, *Occupational Safety and Health Standards for General Industry*.

EXERCISE 1.12-A Identify at least three general safety interfaces used to protect workers from each of the following common industrial and maintenance operations:

- Welding
- Material handling
- Machining
- Cleaning
- Coating

EXERCISE 1.12-B Describe the safety considerations associated with the placement of operations and equipment.

Review 29 CFR Part 1910, Subpart O.

EXERCISE 1.12-C What are “point of operation” hazards?

EXERCISE 1.12-D Using 29 CFR Part 1910, Subpart O, define “guard,” as used in machinery, and state the primary general requirement for machine guards.

EXERCISE 1.12-E Using 29 CFR Part 1910, develop a matrix similar to the one shown below. Use the matrix to identify control measures related to the following workplace environmental hazards:

- Noise
- Thermal burns
- Heat stress
- Eye hazards
- Workplace illumination

Workplace Environmental Hazards and Control Measures	
Hazard	Control Measures
Noise	
Thermal Burns	
Heat Stress	
Eye Hazards	
Illumination	

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Review Chapter 11 of *Fundamentals of Industrial Hygiene*, National Safety Council, or another industrial hygiene-related text that includes content regarding non-ionizing radiation.

EXERCISE 1.12-F Using Chapter 11 of *Fundamentals of Industrial Hygiene*, National Safety Council, or another industrial hygiene-related text that includes content regarding non-ionizing radiation, develop a matrix similar to the one shown below. Use the matrix to identify possible effects and control measures related to the following non-ionizing radiation hazards:

- Ultraviolet radiation
- Visible energy
- Infrared radiation
- Microwaves and radio waves
- Power transmission
- Radar
- Lasers

Non-Ionizing Radiation Hazards and Control Measures		
Radiation Form	Possible Effects	Control Measures
Ultraviolet Radiation		
Visible Energy		
Infrared Radiation		
Microwaves and Radio Waves		
Power Transmission		
Radar		
Lasers		

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3. Summary

General Safety Interfaces

There are many general safety interfaces that are used to protect workers from common industrial and maintenance operations. Some are listed below.

- Welding Establish fire protection, fire watches, personnel protection (i.e., railings, eye protection, protective clothing), health protection and ventilation, etc.
- Material handling Ensure sufficient clearances when using mechanical handling equipment; housekeeping; secure storage; clearance signs; derail and/or bumper blocks on spur railroad tracks; guarding over pits, tanks, vats, ditches; etc.
- Machining Machine guarding, work rests, repairs and maintenance, engineering design, safety devices, etc.
- Cleaning Drains and traps, chip guarding, personal protective clothing, ventilation, solvent selection, fire protection, etc.
- Coating Ventilation, housekeeping, personal protective clothing, fire protection, drying spaces, spray booths, etc.

Placement of Operations and Equipment

The placement of operations activities and the location of equipment is an important safety concern. Sufficient clearances should be ensured when using mechanical handling equipment. Housekeeping must be maintained to ensure access and movement. Storage of material must be secure to maintain clear aisles and passageways. Signs must also be posted that indicate the amount of clearance provided. Structural support must also be adequate to hold necessary equipment and operations.

Machinery Related Hazards

Point of operation hazards exist in machinery at the point at which cutting, shaping, boring, or forming is accomplished on the stock. A machine guard is a barrier that prevents entry of the operator's hands or fingers into the point of operation. There are several OSHA requirements regarding machine guarding. 29 CFR Part 1910.212(a) states that "One or more methods of machine guarding shall be provided to protect the operator and other employees in the machine area from hazards such as those created by point of operation, ingoing nip points, rotating parts, flying chips, and sparks." For more information, refer to the *Machinery and Machine Guarding Surveillance Guide*, prepared by the Oak Ridge Operations Office for the Department of Energy.

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Workplace Environmental Hazards

The following matrix identifies possible effects and control measures related to several workplace environmental hazards:

Workplace Environmental Hazards and Control Measures	
Hazard	Control Measures
Noise	<ul style="list-style-type: none">• Exposure time limitations• Hearing protection• Noise reduction at the source• Noise dampening
Thermal Burns	<ul style="list-style-type: none">• Engineering design• Insulation• Guards• Personal protective clothing
Heat Stress	<ul style="list-style-type: none">• Acclimatization periods• Work and rest regimens• Distribution of work load with time• Regular breaks• Provision for water intake• Protective clothing• Application of engineering controls
Eye Hazards	<ul style="list-style-type: none">• Face shields• Goggles and/or safety glasses• Machine guards• Hand shields• Welding helmets
Illumination	<ul style="list-style-type: none">• Auxiliary lighting• Engineering design

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Non-Ionizing Radiation Hazards

The following matrix identifies control measures related to non-ionizing radiation hazards.

Non-Ionizing Radiation Hazards and Control Measures		
Radiation Form	Possible Effects	Control Measures
Ultraviolet Radiation	<ul style="list-style-type: none"> • Suntan • Sunburn • Eye injury • Cataracts • Decreased skin elasticity • Skin cancer 	<ul style="list-style-type: none"> • Minimize exposure • Eye protection • Skin creams
Visible Energy	<ul style="list-style-type: none"> • Headaches • Eye fatigue 	<ul style="list-style-type: none"> • Vary amount or type of lighting • Reduce glare
Infrared Radiation	<ul style="list-style-type: none"> • Increased tissue temperature • Burns • Eye injury 	<ul style="list-style-type: none"> • Minimize exposure • Protective eyewear • Face shields
Microwaves and Radio Waves	<ul style="list-style-type: none"> • Increased tissue temperature • Burns • Cataracts 	<ul style="list-style-type: none"> • Minimize exposure • Shielding • Door interlocks
Power Transmission	<ul style="list-style-type: none"> • Circadian Rhythm disruption • Diminished field perception 	<ul style="list-style-type: none"> • Minimize exposure • Shielding
Radar	<ul style="list-style-type: none"> • Effects of X-ray radiation (if high voltage) • Increased tissue temperature 	<ul style="list-style-type: none"> • Minimize exposure • Periodic medical examinations • Use of microwave absorber
Lasers	<ul style="list-style-type: none"> • Eye injury • Skin injury 	<ul style="list-style-type: none"> • Minimize exposure • Eye protection

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4. Exercise Solutions

EXERCISE 1.12-A Identify at least three general safety interfaces used to protect workers from each of the following common industrial and maintenance operations:

- Welding
- Material handling
- Machining
- Cleaning
- Coating.

ANSWER 1.12-A There are many possible answers for each of these items. Some are listed below. A correct answer will require three items for each operation.

- Welding -- Establish fire protection, fire watches, personnel protection (i.e., railings, eye protection, protective clothing), health protection and ventilation, etc.
- Material handling -- Ensure sufficient clearances when using mechanical handling equipment; housekeeping; secure storage; clearance signs; derail and/or bumper blocks on spur railroad tracks; guarding over pits, tanks, vats, ditches; etc.
- Machining -- Machine guarding, work rests, repairs and maintenance, engineering design, safety devices, etc.
- Cleaning -- drains and traps, chip guarding, personal protective clothing, ventilation, solvent selection, fire protection, etc.
- Coating -- Ventilation, housekeeping, personal protective clothing, fire protection, drying spaces, spray booths, etc.

EXERCISE 1.12-B Describe the safety considerations associated with the placement of operations and equipment.

ANSWER 1.12-B The placement of operations activities and the location of equipment is an important safety concern. Some of the items that should be considered include the following:

- Sufficient clearances should be ensured when using mechanical handling equipment.
- Storage of material must be secure to maintain clear aisles and passageways.
- Signs must also be posted that indicate the amount of clearance provided.
- Structural support must also be adequate to hold necessary equipment and operations.

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EXERCISE 1.12-C What are “point of operation” hazards?

ANSWER 1.12-C Point of operation hazards are defined as hazards that exist in machinery at the point at which cutting, shaping, boring, or forming is accomplished on the stock.

EXERCISE 1.12-D Using 29 CFR Part 1910, Subpart O, define “guard,” as used in machinery, and state the primary general requirement for machine guards.

ANSWER 1.12-D

- A guard is a barrier that prevents entry of the operator's hands or fingers into the point of operation.
- One or more methods of machine guarding shall be provided to protect the operator and other employees in the machine area from hazards such as those created by point of operation, ingoing nip points, rotating parts, flying chips, and sparks.

EXERCISE 1.12-E Using 29 CFR Part 1910, develop a matrix similar to the one shown in Exercise 1.12-E, Self-Study Exercises. Use the matrix to identify control measures related to the following workplace environmental hazards:

- Noise
- Thermal burns
- Heat stress
- Eye hazards
- Workplace illumination

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ANSWER 1.12-E

Workplace Environmental Hazards and Control Measures	
Hazard	Control Measures
Noise	<ul style="list-style-type: none">• Exposure time limitations• Hearing protection• Noise reduction at the source• Noise dampening
Thermal Burns	<ul style="list-style-type: none">• Engineering design• Insulation• Guards• Personal protective clothing
Heat Stress	<ul style="list-style-type: none">• Acclimatization periods• Work and rest regimens• Distribution of work load with time• Regular breaks• Provision for water intake• Protective clothing• Application of engineering controls
Eye Hazards	<ul style="list-style-type: none">• Face shields• Goggles and/or safety glasses• Machine guards• Hand shields• Welding helmets
Illumination	<ul style="list-style-type: none">• Auxiliary lighting• Engineering design

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EXERCISE 1.12-F Using Chapter 11 of *Fundamentals of Industrial Hygiene*, National Safety Council, or another industrial hygiene-related text that includes content regarding non-ionizing radiation, develop a matrix similar to the one shown in Exercise 1.12-G, Self-Study Exercises. Use the matrix to identify possible effects and control measures related to the following non-ionizing radiation hazards:

- Ultraviolet radiation
- Visible energy
- Infrared radiation
- Microwaves and radio waves
- Power transmission
- Radar
- Lasers

ANSWER 1.12-F

Non-Ionizing Radiation Hazards and Control Measures		
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Visible Energy	<ul style="list-style-type: none"> • Headaches • Eye fatigue 	<ul style="list-style-type: none"> • Vary amount or type of lighting • Reduce glare
Infrared Radiation	<ul style="list-style-type: none"> • Increased tissue temperature • Burns • Eye injury 	<ul style="list-style-type: none"> • Minimize exposure • Protective eyewear • Face shields
Microwaves and Radio Waves	<ul style="list-style-type: none"> • Increased tissue temperature • Burns • Cataracts 	<ul style="list-style-type: none"> • Minimize exposure • Shielding • Door interlocks

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Non-Ionizing Radiation Hazards and Control Measures		
Radiation Form	Possible Effects	Control Measures
Power Transmission	<ul style="list-style-type: none">• Circadian Rhythm disruption• Diminished field perception	<ul style="list-style-type: none">• Minimize exposure• Shielding
Radar	<ul style="list-style-type: none">• Effects of X-ray radiation (if high voltage)• Increased tissue temperature	<ul style="list-style-type: none">• Minimize exposure• Periodic medical examinations• Use of microwave absorber
Lasers	<ul style="list-style-type: none">• Eye injury• Skin injury	<ul style="list-style-type: none">• Minimize exposure• Eye protection